REMARKS/ARGUMENTS

In the specification, the paragraph numbered [insert paragraph no.] has been amended to correct minor editorial problems. The new paragraph added at page 6 discusses in general terms the features taken from Example 4.

Claims 23 and 24 are rejected under 35 USC 112, first paragraph, as failing to comply with the written description requirement.

Applicants' amended paragraph [0036] the specification to comport to claims 23 and 24. The description now refers to the correct units of ohmic resistance i.e., ohm-cm^2. It is noted that those skilled in the art know the correct units for ohmic resistance and would recognise that "ohm/cm^2 " as a typographical error that should have been "ohm-cm^2".

Claims 10-16 and 23-25 are rejected under 35 USC 103(a) as being unpatentable over US Patent Publication 2001/0044043 (Badding) In view of US Patent 4,272,353 (Lawrance).

Claim 10 has been amended. It now states that the electrolyte sheet's "thickness variation is 6.6% to 90% of the average electrolyte sheet thickness." This amendment is supported by the paragraph [0037] of the applicants specification, which describes the upper limit of surface variation as 90%, and by the original claim 10 which provided for thickness variation of at least 2 micrometers and the maximum average thickness of 30 micrometers-hence the lower limit of at least 6.6%.

First, as stated by the Examiner, the Badding reference is silent as to the thickness variation. The Lawrance reference does not provide the relationship between the thickness variation and the average electrolyte sheet thickness. Therefore, because the two references, in combination, do not provide all of the claimed features of

Applicant's claims, claims 10-16 and 23-25 are not obvious over US Patent Publication 2001/0044043 (Badding) in view of US Patent 4,272,353 (Lawrance).

Second, according to the Examiner, the Lawrence reference "also teaches roughening of the surface of the electrolyte to improve adhesion" and that "...it would be obvious ... to modify the roughened surface of Badding with the electrolyte of varying thickness to improve the adhesive property of the electrolyte and improve the connection between the electrode and electrolyte." However, the Badding reference already provides a roughened surface that improves the connection between the electrode and electrolyte, thus making the combination of the two references unnecessary. Furthermore, changing thickness variation beyond what is shown in Badding would not improve adhesion, but it does reduce the ohmic resistance, a feature not disclosed or suggested by the cited references.

Third, the Lawrence reference teaches a different type of electrolyte- a polymer membrane (see, for example, col. 4. lns 21-28, col. 7, lns1-2 and col. 11, lns 61, 62), which has different properties from the one disclosed by the Badding reference and from the one that claimed by the Applicants (one for slid oxide fuel cell -SOFC). The polymer (proton exchange) membrane based art is not analogous to that of solid oxide fuel cell based art. For example, fuel cells based the proton exchange/polymer membranes operate at less than 100°C, while SOFCs operate at more than 600°C. The composition, mechanical, adhesion, and other properties of these two types of electrolytes are very different and the solutions to problems in one type are generally not applicable to another. The bonding mechanism between the polymer membrane and its electrodes and the bonding properties mechanism between the zirconia based (SOFC) electrolyte and its electrodes are also fundamentally different from one another, so one of skill in the art would not look for solution to problems in SOFC to protonic exchange fuel cells. To do so would be akin to looking for problems in airplane

technology to the auto motive art- although both relate to transportation, the two arts are not analogous.

For example, Column 2, lns 43-54 of the Lawrence reference states: "Critical to the method of making the solid polymer electrolyte catalytic electrodes in accordance with the present invention is the roughening or abrading of the surface of the solid polymer electrolyte membrane base member. It is not sufficient that a pattern or design be placed in the surface of the solid polymer electrolyte by embossing, stamping, pressing or otherwise forming a design or pattern therein during manufacture, molding processing or extruding the membrane. The surface of the solid polymer electrolyte membrane must be roughened by frictional or impinging abrasives..." Such abrasion creates "dangling bonds" that were important in polymer membranes. However, such an abrasion method would not work with SOFC electrolytes for the reason described below.

Lawrence utilises 400 grit silicon carbide sand paper (i.e. with particle sized of about 45μm) to sand the polymer membrane. One of skill in the art would recognise that sanding a SOFC electrolyte (which is made of a relatively fragile ceramic material) with thickness of 30 μm or smaller will result in fracture of the electrolyte, and would never attempt to utilise the teachings of Lawrence on the SOFC electrolyte claimed by the Applicants. Even a 150 grit size paper corresponds to silicon carbide particle sizes of about 15μm or more, which are very likely to damage an electrolyte with a thickness of 30 μm or smaller. Thus Lawrence is not only not equivalent art, it is also not enabling with regard to how to create the surface pattern in SOFCs, and actually teaches away from a possible solution of how to make textures SOFC electrolytes (which is described in detail in applicants application). Finally the Lawrence reference discloses the electrolyte thicknesses on the order of 10 mills (250 μm), or a bit less. This is much greater thickness, than that claimed by the applicants.

With regard to the ohmic resistance, the Examiner stated: "Furthermore, the ohmic resistance of the electrolytic sheet is an inherent characteristic of the materials and design. Since the electrolytic sheet is made from the same materials and has the same features as the instant claims, the electrolytic sheet as taught by Badding in view of Lawrence would have an equivalent ohmic resistance as applicant".

Applicant's respectfully disagree with the Examiner's conclusion. Applicant's claimed electrolyte sheet does not have the composition of that of Lawrence, and does not the design disclosed by the Lawrence (or Badding's) reference, because it has a different ratio of thickness variation to the average thickness of the sheet, and because of this different geometry as well as being less than 30um, the claimed electrolyte sheet has a very low ohmic resistance. Such a resistance is not disclosed by any of the cited reference, nor do they teach or suggest that it is even possible to achieve this low resistance.

Ohmic resistance is a function of the electrolyte's thickness and as well as its thickness variation. This is taught by the Applicants on [0036] of the specification. Applicants' claim a very low ohmic resistance, which imply that the ratios of thickness variation and the average electrolyte thickness is outside that known in the art. Neither of the two references teaches the ohmic resistance called for the Applicant, or provides an enabling disclosure. Therefore, absent a specific teaching of the ranges in the ratio of electrolyte sheet thickness relative to the thickness variation, or an example of such a device, one can not assume that the devices described in the cited references, either singly or in combination, would have this ohmic resistance.

Claims 10-16 and 23-24 are rejected under 35 USC 103(a) as being unpatentable over US Patent Publication 2003/0180602 (Finn).

The Finn reference teaches an electrolyte sheet with a height (thickness) variation of less than 5%. Applicants' amended claim 10 to specify that the thickness variation is 6.6% to 90% of the average electrolyte sheet thickness (see, for example, claim 10), which is outside the range taught by Finn.

The Finn reference, alone or in combination with other cited references, do not disclose this feature of claims 10-16 and 23-24. This thickness variation, on the very thin sheets (30 μm or less) is outside the range that those of skill in the art would practice in, because of the concern that such thin SOFC electrolyte sheets would puncture, perforate or fracture during the texturing process, or fracture under stress.

It is noted that the establishment of *prima facie* case of obviousness required that **all of the elements be found in the prior art**. Accordingly, it follows that if **a single element is not found in cited art**, a valid prima facie case can not be established. Moreover, obviousness can only be established by combining or modifying the teachings of prior art to produce the claimed invention where there is a teaching, suggestion or motivation to do so found in the references relied upon. However, hindsight is never an appropriate motivation for combining references and/or requisite knowledge available to one having ordinary skill in the art. To this end, relying upon hindsight knowledge of applicants' disclosure when the prior art does not teach nor suggests such knowledge results in the use of the invention as a template for its own reconstruction. This is wholly improper in the definition for patentability. **As Examiner knows, a prima facie case of obviousness requires a suggestion or motivation to combine, a reasonable expectation of success, and a teaching or suggestion of all claim limitations.** (MPEP §2143.) The teaching or suggestion to modify the Finn reference, as suggested by the Examiner, must be found in the cited prior art; the teaching or suggestion to modify cannot be found in Applicant's disclosure.

Accordingly, because the Finn reference, alone or in combination with other cited references, do not disclose all of the features of claims 10-16 and 23-24, nor suggests the modification, these claims are patentable over the Finn reference.

The Examiner also stated "Regarding claims 16 and 23-24, since the electrolyte layer is made from the same thickness and features, it is inherent that it would have the same flexibility and an equivalent ohmic resistance as applicant." Applicants respectfully disagree with this conclusion. As described above, Ohmic resistance is a function of the electrolyte's thickness and as well as its thickness variation. Applicants' claim a very low ohmic resistance, which imply that the ratios of thickness variation and the average electrolyte thickness is outside that known in the art. The Finn reference does not teaches the ohmic resistance called for the Applicant nor suggests that the electrolyte sheet geometry should (or can be) optimised to provide low ohmic resistance. Therefore, absent a specific teaching of the ranges in the ratio of electrolyte sheet thickness relative to the thickness variation, or an example of such a device, or a teaching that calls for optimization (minimization) of ohmic resistance through specific parameters of the electrolyte sheet, in the cited art itself, one can not assume that the devices described in the cited references, either singly or in combination, would have this ohmic resistance.

The Examiner also stated that "it would be obvious to optimize the thickness of the sheet to balance the resistance of the sheet with a strength of the sheet". It is noted that none of the cited references taught the desirability of doing so, nor provided a suggestion for such optimization, nor even hinted that such optimization is possible. However, hindsight is never an appropriate motivation for combining references and/or requisite knowledge available to one having ordinary skill in the art. To this end, relying upon hindsight knowledge of applicants' disclosure when the prior art does not teach nor suggests such knowledge results in the use of the invention as a template for its own reconstruction. This is wholly improper in the definition for patentability.

Conclusion

Based upon the above amendments, remarks, and papers of records, applicant believes the pending claims of the above-captioned application are in allowable form and patentable over the prior art of record. Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Applicant believes that no extension of time is necessary to make this Reply timely. Should applicant be in error, applicant respectfully requests that the Office grant such time extension pursuant to 37 C.F.R. § 1.136(a) as necessary to make this Reply timely, and hereby authorizes the Office to charge any necessary fee or surcharge with respect to said time extension to the deposit account of the undersigned firm of attorneys, Deposit Account 03-3325.

Please direct any questions or comments to Svetlana Z. Short at 607-974-0412.

Respectfully submitted,

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